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INITIAL FEASIBILITY STUDY FOR EXPLORATION OF THREE U.S. AIR FORCE COURSE MATERIALS FOR ADAPTATION TO CIVILIAN SCHOOL SYSTEMS. FINAL REPORT.

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THE OBJECTIVE OF THIS STUDY WAS TO MAKE AN INITIAL DETERMINATION OF THE FEASIBILITY OF ADAPTING, IMPLEMENTING, AND EVALUATING WITHIN THE UTAH EDUCATIONAL SYSTEM THREE AIR FORCE COURSES--ELECTRONICS PRINCIPLES, MEDICAL SERVICE SPECIALIST COURSE, AND AIRCRAFT MECHANICS. THE FIRST PHASE OF THE STUDY WAS CONCERNED WITH ESTABLISHING CRITERIA AGAINST WHICH THE INITIAL ASSESSMENT OF FEASIBILITY COULD BE MADE. FACTORS INVOLVED WERE--(1) TERMINAL OBJECTIVES, (2) PREREQUISITE BEHAVIORS, (3) INSTRUCTIONAL SCOPE, (4) INSTRUCTIONAL STRATEGIES AND METHODS, (5) STUDENT MOTIVATION AND ATTITUDES, AND (6) STUDENT PROFICIENCY YIELD. THE SECOND PHASE DEALT WITH THE SELECTION OF MANAGEABLE SEGMENTS FROM EACH COURSE, REVIEW OF THE SEGMENTS, AND RENDERING JUDGMENTS CONCERNING THE FEASIBILITY OF CONTINUING THE STUDY. ALTHOUGH FEASIBILITY VARIED SOMEWHAT AS A FUNCTION OF COURSE SEGMENT, IT IS FEASIBLE TO PROCEED WITH ADAPTATION, IMPLEMENTATION, AND EVALUATION OF THE THREE AIR FORCE COURSE SEGMENTS. IT IS LIKELY THAT MANY CIVILIAN EDUCATION SYSTEMS COULD BENEFIT GREATLY FROM USE OF SELECTED MILITARY INSTRUCTIONAL COURSES. IT WAS RECOMMENDED THAT STEPS BE TAKEN IMMEDIATELY TO PROCEED WITH THE PROGRAM IN UTAH. (HC)

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Aerospace Education Foundation

Washington, D.C.

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OFFICE OF EDUCATION

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INTRODUCTION

Within the years ahead, the requirements placed upon American educational systems will accelerate at a rapidly increasing rate. The nature of these requirements will be quantitative and qualitative--not only will these systems have to accommodate vastly greater student numbers, they also will have to yield persons who can man the increasingly complex demands of modern society with higher and higher proficiency.

We already have passed the point where the answer to meeting accelerated educational requirements can be found in a simple expansion of traditional educational practices. Today, the nation on the whole is experiencing serious, and, in specific instances, critical, teacher shortages. Further, an extrapolation of costs for a linear expansion of physical facilities and personnel soon leads to serious consideration of economic feasibility. Therefore, even if it were desirable to meet the problem of rapidly increasing quantitative and qualitative requirements with a "more-of-the-same" approach, such an approach, where difficult today, may be impossible within the foreseeable future.

However, many persons are taking the position that even if no economic constraints existed, there are other important reasons to question the soundness of an approach that is, for the most part, a simple expanding of existing educational practices. Many of these reasons involve technical considerations--particularly considerations concerning how to bring about behavioral change as a function of the "educational environment". These persons are primarily concerned with meeting, to the extent possible, quantitative and qualitative requirements by improving educational practices. Their general approach has been to apply behavioral and systems-science technology to educational practices; the result has been a rapidly expanding technical endeavor--an endeavor commonly called "educational technology".

Background

A number of pioneering efforts in educational technology have been conducted by the United States Air Force. Over the years, a wide array of Air Force courses, incorporating various aspects of educational technology, has been developed and implemented. The success of these courses has been an important demonstration of the powerful effects that can be realized from application of educational technology. These courses have gone a long way toward meeting the increased quantitative and qualitative requirements placed upon Air Force training systems--a result that a priori appears to be highly analogous to what is, and increasingly will be, expected from public-education systems.

Because of considerations such as these, educational leaders, during the Fall, 1966, Seminar of the Aerospace Education Foundation, expressed the belief that the Foundation could serve an important catalytic role in the application of educational technology, as incorporated in Air Force courses, to the civilian classroom. The rationale was that if such a translation reasonably could be made, a large and powerful reservoir of Air Force experience could be brought to bear upon the increasing requirements placed upon civilian educational systems. The Chief of Staff, United States Air Force, enthusiastically agreed to have the Aerospace Education Foundation serve as liaison with the educational community in exploring the value of Air Force courses for civilian educational systems.

During approximately the same period, educators within the state of Utah were concerned with producing radical improvements in selected educational areas. Through the Utah Chapter of the Air Force Association, the interests of the Aerospace Education Foundation in possible adaptation of Air Force courses were made known to them. As a result of further discussions between representatives from Utah and the Foundation, it was agreed that Utah's public-education system would serve as a "laboratory" for testing the feasibility of Air Force course adaptation, implementation, and evaluation.

On the initiative of the Aerospace Education Foundation, representatives from Utah's Division of Vocational and Technical Education reviewed a preliminary list of 19 courses presently being offered by the Air Force. From these courses, three were selected as having priority for the educational requirements of Utah: (1) medical service specialist, (2) aircraft mechanics, and (3) electronic principles. The selection of these three courses compared favorably with national priority requirements. This was determined through review of the courses with U.S. Office of Education personnel.

Problem

With the selection of the three Air Force courses for exploration purposes, the problem was made explicit: to what extent is it feasible to consider bringing existing Air Force courses to bear upon the stated educational requirements of public-education systems, beginning with the state of Utah?

This, then, was the specific problem to which the work reported here was directed. In the work, first priority was given to the specific case represented by Utah's educational requirements. At all times, however, a point of view toward the broader problem of translation of military courses to public education in general was maintained. It is expected that more specific answers to the latter problem ultimately will be obtained.

Objective

The primary objective of the work reported here was to make an initial determination of the feasibility of proceeding to adapt, implement, and evaluate within the Utah educational system the three Air Force courses selected by the Utah representatives.

The next section of this report describes in some detail the procedures employed to accomplish this objective.

METHOD

To accomplish the above objective, two work phases were completed. The work accomplished in connection with each phase is described below.

Phase I - Criteria and Capability Establishment

At the outset of the work, it was considered desirable to establish clear guidelines by which the determination of feasibility would be made. To do this, consideration was given to establishing a set of criteria to assist persons with varying types of expertise in making judgments relative to determining the feasibility of adapting, implementing, and evaluating the three Air Force courses. Therefore, one task was generating such criteria. The second task constituting this phase was establishing and securing the kinds of expertise that would permit assessment of feasibility in accordance with the criteria.

Generating Criteria

It appeared that any assessment of the feasibility of proceeding to adapt, implement, and evaluate the selected Air Force courses would have to take into account, at a minimum, several factors. One factor is the degree of compatibility between the terminal objectives of each course and the terminal objectives (requirements) of the public-education system. Therefore, a first criterion established to assess feasibility was: acceptable compatibility of terminal objectives.

A second factor believed to be of importance is the required entering behaviors (prerequisites) of students. This factor has to do with what students must be able to do before the instruction of interest

can begin. It was believed that the degree of compatibility between entering behaviors required by the Air Force and those behaviors that students within Utah normally are capable of demonstrating upon entering the instruction should be examined. Consequently, a second criterion that was established was: acceptable compatibility of entering behaviors.

Intra-course scope was a third factor believed to be of importance. By this is meant the scope of instruction as measured by intermediate (enabling or contributing) objectives included within the course. (This factor, in some educational settings, also is referred to as the content of instruction.) Although attainment of intermediate objectives is a necessary condition for attainment of terminal objectives, terminal objectives often do not contain explicit statements of intermediate objectives. Consequently, it was judged that an assessment of feasibility should include examination of the extent to which the scope of the Air Force courses is compatible with the requirements of public education within Utah. To accomplish this, a third criterion established was: acceptable compatibility of instructional scope.

It also was believed that assessment of feasibility should include attention to the factor of instructional strategies and methods. This factor has to do with the rationale underlying the instruction as well as with the instructional media, training aids, and precisely how the instruction is implemented (e.g., lectures, discussions, programmed instruction). The degree to which the requirements established by this factor in the Air Force courses can be met by the Utah educational system enters into what is required for adaptation and implementation of the courses. To take this factor into consideration, a fourth criterion established was: acceptable compatibility of instructional strategies and methods.

A fifth factor that entered into consideration was the likely effects on student motivation and attitudes. Although any assessment of this factor might be purely judgmental, it was believed that it should be considered in relation to the feasibility of utilizing Air Force courses. Therefore, another criterion was established: acceptable student motivation and attitudes.

A final factor considered to be of prime importance is the degree of student achievement yielded by the Air Force courses. This factor refers to the proficiency standard established by the Air Force and the extent to which it is routinely met (validation). How this proficiency relates to the requirements of Utah, it was believed, should be considered. Consequently a sixth criterion established was: acceptable student-proficiency yield.

The six criteria stated above were believed to be the central ones against which the feasibility of proceeding to adapt, implement,

and evaluate the three selected Air Force courses should be determined. As stated earlier, these criteria served as the general guidelines for the subsequent judgmental review of the courses.

Securing Capabilities

In reviewing the established criteria, it was clear that the initial feasibility assessment would require persons with expertise in several areas. One area was general leadership, direction, and coordination for the work. This responsibility was assumed by personnel of the Aerospace Education Foundation. A second capability area needed was familiarity with the overall requirements within Utah and coordination of the work to be accomplished within the state. This capability was provided by a representative from the Office of the State Superintendent of Public Instruction within Utah. Also needed were personnel in the capability area of instruction within the specific areas represented by the three selected Air Force courses. This capability was provided by Utah educators within these areas. A fourth capability area required was in current educational technology. This was provided by a staff member from the Columbus Laboratories of Battelle Memorial Institute. A final capability requirement that was foreseen as a possible need was a specialist in educational television. This was provided by a consultant to the Aerospace Education Foundation. The names and affiliations of personnel involved in the project are included as the Appendix.

Upon completion of these two tasks, the second phase of the project was undertaken.

Phase II - Course Review and Study

The principal method employed for this phase was course review, study, and judgments by personnel with expertise in the overall requirements of Utah, personnel with expertise in the specific areas of instruction, personnel with expertise in educational technology, and personnel with expertise in educational television.

The initial course review for the medical service specialist course and the aircraft mechanics course was conducted at Sheppard Air Force Base, Texas, from August 28 through September 1, 1967. For the electronic principles course, this review was conducted at Lowry Air Force Base, Colorado, from October 30 through November 3, 1967. Additional review of course materials was conducted by these same personnel upon return to their various "home" locations. A final review and discussion of the three Air Force courses was held November 17 and 18, 1967, at Park City, Utah, with all primary personnel involved in the project present.

In each of the initial course reviews (i.e., at Sheppard and Lowry Air Force Bases), several procedures were employed. One was discussions with personnel who were responsible for the overall administrative control of each Air Force course. From these personnel it was possible to get the "big picture" with respect to the course. That is, such information as total number of trainees who had been through the course, average proficiency attained by trainees, and average percentage of students failing to achieve satisfactory proficiency were generally reviewed by these type of personnel.

A second procedure was discussions with personnel more closely connected with the course administration, in some cases including instructors. The types of information obtained from these personnel were general procedures for conducting the courses on a day-to-day basis, particular problems encountered within the courses, particularly effective parts of the courses, etc.

A third procedure employed was observation of typical instructional situations included in the courses. Here it was possible for members of the project team to see various units of the courses being administered to the trainees.

A fourth procedure employed was an initial, yet somewhat detailed, study of the instructional materials associated with each course. The types of materials studied included plans of instruction, student guides, student workbooks, evaluation instruments, programmed-instruction materials, training aids, film strips, motion pictures, and closed-circuit television. The primary information gained from this procedure concerned course objectives, student evaluation, student motivation, instructional strategies and methods, instructional scope, and student prerequisites. This procedure required the majority of time allowed for the initial course reviews. The results obtained from these procedures are presented later in this report.

Upon return to the various home locations, a variety of procedures were employed to continue the study of the courses. For example, in connection with the aircraft mechanics course, a number of intermediate objectives were selected from four different plans of instruction as representing those of greatest potential value for meeting the requirements of Utah. These objectives were compiled, and associated instructional materials were further reviewed. As a second example, selected programmed-instruction materials associated with the medical service specialist course were tried with students in Utah in order to obtain a preliminary assessment of the effectiveness of the materials and student attitudes toward them. The results obtained from these procedures also are presented later in this report.

In addition, the course materials were reviewed from the standpoint of educational technology. Particular attention was given to those changes, if any, necessary for implementing the courses within the

Utah school system. The results obtained from this review also are included later in this report.

It was believed that the project activities could be meaningfully concluded by holding a final review meeting for the primary project staff members. This was done during November 17 and 18 at Park City, Utah. The activities of this meeting centered around several topics of considerable importance for the project.

One of these topics was a more precise delineation of the sections of the Air Force courses of primary interest to the Utah representatives. At the conclusion of discussions on this topic, a clear specification of the selected course segements existed.

A second topic of principle interest was securing judgments of the project staff concerning the feasibility of proceeding to adapt, implement, and evaluate the course segments that had been selected. To assist in securing these judgments, six-point rating scales, consistent with the criteria generated for assessing feasibility, were administered to members of the project staff. It was believed that these rating scales would assist in giving some uniform structure within which the project staff could make their judgments known. However, it was realized that the rating scales did not meet the assumptions implicit in scaling procedures, and in this sense were not useful for statistical manipulations. Consequently, the results obtained should be viewed simply as one means by which the project staff could make their judgments explicit.

A third topic considered at the final review meeting was future requirements for moving into a pilot study designed to adapt, implement, and evaluate the Air Force courses within various Utah educational institutions. These considerations included software requirements, hardware requirements, personnel and facility requirements, and associated cost requirements for such a pilot study. Structure for these considerations was provided by worksheets designed for the meeting.

RESULTS

The results obtained by the project staff for each of the three Air Force courses are presented below. For clarity, each course is treated separately.

Medical Service Specialist Course

The medical service specialist course and other related courses conducted by the Medical Service School, Sheppard Air Force

Base, Texas, were reviewed by members of the project staff. As a result of these reviews, a 30-hour segment of instruction was selected for further exploration for the Utah school system. This segment is composed of instruction designed for attainment of objectives selected from two Air Force plans of instruction (POI's): POI ABR 90230 and POI AQR 90010. The specific titles of the units making up the 30-hour segment are: The Human Body and Its Functions; Prefixes, Roots, and Suffixes of Medical Terminology; Psychological Aspects of Illness; and Public Relations for the Medical Service Specialist. Typical methods incorporated within the 30-hour segment include linear programmed instruction, linear programmed instruction with branching, programmed lectures utilizing tape recordings, film strips, and instructor-led seminars.

The 30-hour segment that was selected would form the basis for a total of 190 hours of instruction in the Nurse Aide Course at the Utah Technical College, Salt Lake City, Utah (a post-secondary technical institute). Besides the 30 hours of instruction provided by the Air Force units, there would be 60 hours of outside study time and 100 hours of laboratory application, the latter two time blocks based upon the 30-hour segment of instruction. It is estimated that the total number of students who would be available for an initial pilot study would be 35 to 40. Their educational level at the beginning of the pilot study would be 12 academic years or the equivalent.

As indicated earlier in this report, the initial assessment of feasibility for proceeding to adapt, implement, and evaluate the Air Force course materials was made according to six criteria. The results of this assessment for the selected medical service specialist units are presented below.

Acceptability of Terminal Objectives

To assess the compatibility of the terminal objectives of the Air Force course segment with the requirements within Utah, a six-point rating scale was provided. A rating of "0" would indicate a judgment of absence of compatibility; a rating of "5" would indicate a judgment of perfect compatibility. Therefore, any rating greater than zero would indicate a judgment that compatibility existed, with the judged degree of compatibility increasing as the rating approached 5.

Only one of the two Utah representatives concerned with this course was available for the rating procedure. (The second representative recently underwent major surgery and was not available.) On the rating scale designed to assess the extent of compatibility of terminal objectives of the Air Force course segment with the requirements within Utah, a rating of 3 was given by the Utah representative.

Acceptability of Prerequisite Behaviors

A six-point rating scale also was provided to assess the degree of compatibility between the Air Force requirements for prerequisite behaviors upon entering the segment of instruction and those behaviors normally demonstrable by students who would be entering the instruction within Utah. A rating of "0" on this scale would indicate a judgment of absence of compatibility; a rating of "5" would indicate a judgment of perfect compatibility. The rating given by the Utah representative on this scale was 5.

Acceptability of Instructional Scope

To assess the degree of compatibility between the scope (as measured by enabling or contributing objectives) of the Air Force course segments and the scope of instruction required within Utah, a six-point rating scale also was provided. Again, a "0" rating would indicate a judgment of absence of compatibility and a "5" rating would indicate one of perfect compatibility. The Utah representative gave a rating of 3 on this scale.

Acceptability of Instructional Strategies and Methods

To provide an assessment of the extent to which instructional-strategy-and-method requirements established by the Air Force were usable within Utah, a fourth six-point rating scale was provided. A rating of "0" on this scale would indicate a judgment that the requirements established by the Air Force would make the Air Force course segment totally unusable. A rating of "5" would indicate a judgment that instructional-strategy-and-method requirements for the Air Force courses were totally usable within Utah. The Utah representative on this scale gave a rating of 4.

In connection with assessing feasibility of adapting the Air Force course segments to the Utah school system, it also was desirable to secure a judgment of the soundness of the educational technology incorporated in the selected Air Force course segment. To do this, a six-point rating scale was provided for the Battelle representative. A rating on this scale of "0" would indicate a judgment that the educational technology was "poor". A rating of "5" would indicate that the educational technology was judged to be "outstanding". The Battelle representative gave a rating of 4.

Acceptability of Student Motivation and Attitudes

Two six-point rating scales were provided to assess judgments on how the Air Force course segment would affect student motivation and attitudes. One scale dealt with motivation; the second dealt with attitudes. Both the Utah and the Battelle representative were asked to respond on both of these scales--the Utah representative from the standpoint of her familiarity with Utah students, and the Battelle representative from the standpoint of the general effects of educational technology on student motivation and attitudes.

A rating of "0" on the first scale would indicate a judgment that the Air Force course segment would reduce student motivation to a low level while a rating of "5" would indicate a judgment that the course segment would increase student motivation to a high level. The Utah representative gave a rating of 3; the Battelle representative gave a rating of 3.5.

On the second scale, a rating of "0" would indicate a judgment that the Air Force course segment would produce very poor student attitudes. Conversely, a rating of "5" would indicate that students would have very favorable attitudes toward the course segment in the judgment of the raters. The Utah representative provided a rating of 3 on this scale. The Battelle representative provided a rating of 4.

Acceptability of Student-Proficiency Yield

To assess the extent that student proficiency yield from the Air Force course segment would meet proficiency requirements within Utah, a final six-point scale was provided. (Each Utah representative was briefed on Air Force validation data during the field reviews of the Air Force courses. Judgments in relation to this factor had to take into account these data plus deviations between Air Force and Utah students and deviations between Air Force and Utah control of students.) A judgment that there was an absence of compatibility between Air Force proficiency yield and the proficiency requirements within Utah (taking into account what reasonably could be expected from Utah students using the Air Force course segment) would be reflected by a rating of "0". A judgment of perfect compatibility would be indicated by a rating of "5". The Utah representative gave a rating of 4 on this scale.

Other Results

Several other judgmental and observational results that were not as specifically formulated should be reported. First, the enthusiasm of both of the Utah representatives concerned with the selected

Air Force course segment for health occupation within Utah is quite high. Some of the Air Force programmed-instruction booklets were tried by them with a small group of students. The learning and reaction of these students resulting from the try-out were quite favorable. Both Utah representatives are quite anxious to investigate additional Air Force materials as the health occupations program within Utah is expanded to include other courses.

Second, a preliminary assessment of what would be required in terms of cost for adaptation (not implementation and evaluation) of the Air Force course segments was made. These costs, from the standpoint of benefits that could be derived from adaptation, appear to be quite favorable.

Aircraft Mechanics

Several aircraft mechanics courses conducted by the Department of Aircraft Maintenance Training, Sheppard Air Force Base, Texas, were reviewed by a member of the project staff. As a result of these reviews, a 60-hour segment of instruction was selected for further exploration for the Utah school system. This segment is made up of instruction designed for attainment of 51 objectives distributed among four Air Force plans of instruction: POI AAR 43171, POI ABR 43131A, POI ABR 43131C-1, and POI ABR 43131F. The topical area of instruction represented by these objectives is aircraft tires, wheels, and brakes.

The general method employed for this segment typically includes lectures, demonstrations, and discussions involving an instructor, supported heavily by student activities that are closely guided by use of workbooks and study guides. The instruction also includes use of a variety of instructional aids such as slides, training films, reference materials, and trainers.

The 60-hour segment selected would be implemented within a two-year Aircraft Mechanics Program conducted by the Department of Industrial and Technical Education, Utah State University, Logan, Utah. The estimated total number of students who would be available for an initial pilot study is 30. The educational level of these students at the beginning of the pilot study would be 13 years of formal schooling.

The procedure for the initial assessment of the feasibility of proceeding to adapt, implement, and evaluate the aircraft mechanics course segment was the same as that employed in connection with the medical service specialist course segment. The results of administering the six-point rating scales in connection with the aircraft mechanics course segment are presented below. One Utah representative completed the rating scales for this course segment.

Acceptability of Terminal Objectives

On the rating scale designed to assess the degree of compatibility between the objectives of the Air Force course segment and the requirements within Utah, the Utah representative's judgment was indicated by a scale rating of 3.25 (0 = absence of compatibility; 5 = perfect compatibility).

Acceptability of Prerequisite Behaviors

The extent to which student behaviors required by the Air Force at the beginning of instruction are compatible with student behaviors that normally can be expected at that point within Utah was the factor being assessed by the second rating scale. The Utah representative's judgment on this matter was reflected by a 3.5 scale rating (0 = absence of compatibility; 5 = perfect compatibility).

Acceptability of Instructional Scope

The third rating scale dealt with the extent to which the instructional scope of the aircraft mechanics course segment was compatible with scope requirements within Utah. A 3.25 scale rating indicated the Utah representative's judgment in relation to this factor (0 = absence of compatibility; 5 = perfect compatibility).

Acceptability of Instructional Strategies and Methods

The usableness of the instructional-strategy-and-method requirements established by the Air Force in the context of the Utah educational setting was the factor being assessed by a fourth rating scale. The Utah representative gave a rating of 3.25 on this scale (0 = totally unusable; 5 = totally usable).

The Battelle representative responded to a fifth rating scale designed for judgments concerning the soundness of the educational technology incorporated in the course segment. His judgment was reflected by a scale rating of 3 (0 = poor; 5 = outstanding).

Acceptability of Student Motivation and Attitudes

The sixth and seventh rating scales were concerned with judgments about the effects of the aircraft mechanics course segment

on student motivation and attitudes. Again, both the Utah and Battelle representatives responded on these two rating scales.

With respect to the motivational effects, the Utah representative's judgment was reflected by a scale rating of 3.5; the Battelle representative gave a scale rating of 3 (0 = reduce motivation to a low level; 5 = increase motivation to a high level).

The effect of the course segment on attitudes was judged by the Utah representative with a scale rating of 4. Again, the Battelle representative gave a scale rating of 3 (0 = very poor student attitudes; 5 = outstandingly high student attitudes).

Acceptability of Student-Proficiency Yield

The final rating scale dealt with the extent to which Air Force proficiency yield (as modified by differences attributable to Utah students and extent of civilian control of students) would meet requirements within Utah. The Utah representative's judgment in connection with this factor was reflected by a scale rating of 3 (0 = absence of compatibility; 5 = perfect compatibility).

Other Results

Several other results from the course review should be reported. One is that although the enthusiasm for the pilot study is high with respect to the aircraft mechanics course segment, there are some very practical reservations. One reservation is that there is uncertainty concerning some of the precise requirements for aircraft mechanics that exist within Utah. Before instruction designed to meet each objective selected from the Air Force courses is implemented, it would be desirable for Utah representatives to determine whether or not some of the selected objectives fail to meet the needs of Utah employers. This would be done by having potential employers review the selected objectives. Some progress in this direction will be made before the end of 1967. However, inasmuch as this reservation applies only to a small segment of the selected objectives, the overall effect is not anticipated to be adverse with respect to the total course segment.

Another reservation deals with the compatibility of certain Utah-owned hardware with Air Force software. Although it was not possible to examine this matter in detail during the course of the present work, it is reasonable to assume that any necessary adaptation of software could be made at a cost that would be favorable when compared with the benefits that would be realized.

Electronic Principles

The Standardized Electronic Principles course conducted by the Lowry Technical Training Center, Lowry Air Force Base, Colorado, was reviewed by four members of the project staff. As a result of these reviews, a 90-hour segment of instruction was selected for further exploration within the Utah school system. The 90-hour segment is made up of instruction designed for attainment of a large block of objectives contained in one Air Force plan of instruction: POI AQR 32020. DC circuits is the topical area of instruction represented by these objectives.

A number of methods are included in this instructional segment. Typical of these are lectures and discussions supported by closed-circuit television presentations (also available on 16 mm films) and closely guided student activities. Student activities include the use of trainers and various pieces of equipment normally associated with electronics (e.g., multimeter, multipurpose components).

The total 90-hour segment (as well as other segments in electronic principles) is systematized by a procedure that the Air Force calls "standardized instruction". This means that extremely close control of all stimulus materials and all student activity is maintained and that these instructional aspects are the same, to the extent possible, for all students. However, the standardized instruction does provide for remedial training for those students who fail to meet intra-course proficiency requirements.

The 90-hour DC circuit course segment would be implemented within five Utah educational institutions: (1) Electronic Technology Department, Utah Technical College, Provo, Utah (a two-year technical institute); (2) Electronics Department, Utah Technical College, Salt Lake City, Utah (also a two-year technical institute); (3) the Electronic Technician Program, School of Technology and Institute of Trade-Technical Education, Weber State College, Ogden, Utah (a two-year technical program in a four-year college); (4) Dixie College, St. George, Utah (a junior college); and (5) Electronics Department, Sevier Valley Technical School, Richfield, Utah (a high school). From the five institutions, a total of approximately 175 students would be available for the pilot study. The educational level of the students at the beginning of the pilot study would be 12 academic years for the four post-secondary institutions, and 10 or 11 academic years for the high school.

The procedure for the initial assessment of the feasibility of proceeding to adapt, implement, and evaluate the electronic principles course segment was the same as for the previous two course segments. The results of administering the six-point rating scales are presented below. Four Utah representatives concerned with electronic principles were available for the rating procedure.

Acceptability of Terminal Objectives

The degree of compatibility between the selected Air Force objectives and the requirements within Utah was judged to be the same by all four Utah representatives: each gave a scale rating of 4 (0 = absence of compatibility; 5 = perfect compatibility).

Acceptability of Prerequisite Behaviors

In the judgment of the four Utah representatives, there is perfect compatibility between student behaviors required by the Air Force upon entering the selected electronic principles course segment and those that normally can be expected at that point from Utah students. All Utah representatives gave a scale rating of 5 on this factor (0 = absence of compatibility; 5 = perfect compatibility).

Acceptability of Instructional Scope

The judgment of the Utah representative in relation to the extent to which the scope of the Air Force course segment is compatible with scope requirements within Utah also was unanimous. All representatives gave a scale rating of 4 on this factor (0 = absence of compatibility; 5 = perfect compatibility).

Acceptability of Instructional Strategies and Methods

The fourth rating scale assessed the extent of usableness of the instructional-strategy-and-method requirements as established by the Air Force for the course segment in the context of the Utah education setting. Three of the Utah representatives indicated their judgment on this factor with a scale rating of 5. The other representative's judgment was reflected by a scale rating of 4 (0 = totally unusable; 5 = totally usable).

The judgment of the Battelle representative with regard to the soundness of the educational technology incorporated into the electronic principles course segment was measured by a scale rating of 3.5 (0 = poor; 5 = outstanding).

Acceptability of Student Motivation and Attitudes

The sixth and seventh rating scales were concerned with judgments concerning the effects of the electronic principles course segment on student motivation and attitudes. The Battelle representative joined with the Utah representatives in giving judgments on these matters.

With respect to motivational effects, there was some variation in the judgments. Two Utah representatives gave a scale rating of 3, one gave a scale rating of 2.5, and one a scale rating of 2. The Battelle representative gave a scale rating of 3.5 (0 = reduce motivation to a low level; 5 = increase motivation to a high level).

The Utah representatives generally agreed on the effects of the course segment on student attitudes. The judgment of two representatives was indicated by a scale rating of 3.5 and that of the two other representatives by a scale rating of 4. The Battelle representative gave a scale rating of 3.5 to reflect his judgment on this matter (0 = very poor student attitudes; 5 = outstandingly high student attitudes).

Acceptability of Student-Proficiency Yield

There also was near agreement in the judgments of the Utah representatives regarding the extent to which Air Force proficiency yield (as modified by differences attributable to Utah students and extent of civilian control of students) would meet Utah's requirements. Three Utah representatives gave a scale rating of 4; one gave a rating of 3 (0 = absence of compatibility; 5 = perfect compatibility).

Other Results

Great enthusiasm for proceeding to adapt, implement, and evaluate the electronic principles course segment within Utah exists among the four Utah representatives concerned with electronics. This point is significant because at the beginning of the project the electronics group had, perhaps, the most serious reservations concerning feasibility. At this point, it appears that these reservations have changed to high enthusiasm as a function of having examined the Air Force course segment.

A preliminary examination of adaptation costs (not implementation and evaluation costs) for the electronic principles

course segment has indicated that these costs are very favorable in view of the benefits that would be derived.

Summary of Rating Scale Results

The results obtained from the rating scale activities for all three Air Force course segments have been summarized. This summary is presented as Table 1.

DISCUSSION

The nature of the work that was proposed and was conducted yielded judgmental results. As indicated earlier in this report, the rating scales used to obtain many of the judgments did not (nor could they within time and fund limitations) yield data that could be subjected to statistical analyses. Nevertheless, the rating scales did provide a workable structure for the project staff in making their judgments explicit. Therefore, this section of the report will be limited to several interpretations that are based upon the rating scale results obtained, as well as upon observations that were made during the course of the work.

It is certainly true that the Utah representatives involved in this work view the instructional potential of the selected Air Force course segments with high enthusiasm coupled with an understanding of specific problems that would have to be overcome before implementation could be realized. Further, the Utah representatives were quite aware of the vast reservoir of additional instructional potential represented by the many other Air Force courses that were not considered in this work. With this combined short- and long-range view, high enthusiasm, cooperation, and willingness were keynoted throughout the work. It probably is accurate to interpret these observations as meaning that although specific problems will be encountered, the total of them in no way preclude, in the judgment of the Utah educators, the successful translation of many Air Force courses to meet the requirements of the civilian education system within Utah.

From the standpoint of educational technology, several interpretations can be offered. There is a difference between "maximum" and "optimum" educational efficiency and effectiveness. To maximize educational efficiency and effectiveness means, in a general sense, to operate in the total absence of constraints. To optimize means to operate with constraints. The educational technology incorporated within the Air Force courses that were reviewed suggest that the Air Force, understandably, has attempted to optimize instruction. Consequently, when compared with what would be possible if maximization were feasible, the educational technology incorporated in the Air Force courses falls short.

TABLE 1. SUMMARY OF INITIAL FEASIBILITY ASSESSMENT THROUGH RATING SCALE RESPONSES

Factor Being Rated	Rating Given—Medical[a]	Rating Given—Aircraft Mechanics[a]	Rating Given—Electronics[a]
Terminal Objectives	3.00	3.25	4.00[c]
Prerequisite Behaviors	5.00	3.50	5.00[c]
Instructional Scope	3.00	3.25	4.00[c]
Instructional Strategies and Methods			
Usability	4.00	3.25	4.75[c]
Soundness	4.00	3.00	3.50
Student Motivation and Attitudes			
Motivation	3.25[b]	3.25[b]	2.80[d]
Attitudes	3.50[b]	3.50[b]	3.70[d]
Student Proficiency Yield	4.00	3.00	3.75[c]

[a]Six-point rating scale employed; 0 to 5 range

[b]Average of two ratings

[c]Average of four ratings

[d]Average of five ratings

On the other hand, civilian educational institutions also have to optimize. However, it appears that in general these institutions operate in the face of more (and/or different) constraints than the Air Force. Consequently, Air Force optimization, when compared with civilian optimization, results in many aspects of educational technology in which the Air Force has considerable superiority.

It is plausible to expect that this situation is generally the case throughout the nation. If this is true, it can be interpreted to mean that from an educational-technology standpoint, civilian schools stand to benefit considerably from the translation of Air Force courses to assist them in meeting their requirements. This certainly appears to be the case for civilian schools in Utah.

In addition to representing specific judgments, the rating-scale data provide a basis for some overall interpretations. It can be seen (reference Table 1) that in relation to each of the three course segments the project staff's judgment on the initial determination of the feasibility of proceeding to adapt, implement, and evaluate the course segments was, at a minimum, favorable. That is, when viewed in reference to the six criteria that were established for the initial determination of feasibility, the three Air Force courses fared, at a minimum, acceptably well, and, at a maximum, quite well. Consequently, on the whole the project staff's judgment is interpreted to mean that it is feasible to proceed to adapt, implement, and evaluate <u>each</u> of the three Air Force course segments that were selected.

However, there appears to be some inter-course differences with regard to feasibility. In an overall sense, the feasibility of proceeding to adapt, implement, and evaluate the electronic principles course segment must be judged as highest. There are several reasons for this. First, the judgments on the six factors in relation to this course were generally more favorable. Second, the larger number of students who would be involved and the greater variety of educational institutions from which they would come would produce evaluation data from which more general inferences could be made. Third, implementation requirements for instructional hardware and software when compared with the benefits that would be derived from the data obtained during evaluation do not appear to be excessive.

The course segment appearing to have second highest feasibility is the one selected for the Utah nurse aide course. Judgments on the six factors, although very favorable, did not consistently equal those for the electronic principles course segment. Further, because of the more limited student numbers and because only one institution would be represented, it appears that the evaluation data would be inferentially more limited. On the other hand, it is probable that adaptation and implementation costs for this course segment would be lower than for either of the other two.

The aircraft mechanics course segment appears to have third highest feasibility. Although student numbers and the single institution represented are about the same case as that found for the nurse aide course, adaptation and implementation costs probably would be higher than those for the nurse aide course. Additionally, the judgments on the six factors, although acceptable, generally were not as favorable as for the other two course segments.

From the proceding discussion, it can be seen that the results of the initial determination of feasibility for proceeding to adapt, implement, and evaluate the three Air Force course segments have been interpreted to mean that proceeding along these lines is feasible in each of the three cases. Further, these results have been interpreted to mean that there is differential feasibility; however, this should not preclude the further investigation of each of the three course segments.

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The conclusions, implications, and recommendations from this work are treated separately below.

Conclusions

The major conclusion from this study is unequivocal: in the judgments of qualified personnel, it is feasible to proceed to adapt, implement, and evaluate within the Utah educational system the three Air Force course segments that were selected during this study.

Implications

The implications of this study are clear. If a group of qualified persons judge that a particular sample of military instructional courses drawn from a reservoir of such courses are appropriate for a specified civilian educational system, it is more likely (than before this was known) that such a finding would be the same in a number of other relatively similar situations. This has important and very practical meaning. In the most general sense, it means that a number of civilian educational systems throughout the nation are likely to gain significantly improved instructional systems at a relatively modest cost if they attend to the vast reservoir of military instructional courses that presently exist. The value of these courses is likely to be distributed along the educational spectrum--certainly from secondary through post-secondary education. The nature of these courses is such that they can be incorporated well into overall planning for these educational levels both locally and nationally.

Recommendations

It is strongly recommended that immediate steps be taken to proceed to adapt, implement, and evaluate the electronic principles, the medical service specialist, and the aircraft mechanics course segments within the Utah public-education system. Immediacy is important; enthusiasm is high and momentum has been established. Lengthy delays would likely reduce significant aspects of what already has been accomplished.

SUMMARY

The general problem to which this work was directed is assisting public-education systems in meeting the increased quantitative and qualitative requirements being placed upon them. The specific problem that was addressed is: to what extent is it feasible to consider bringing existing Air Force courses to bear upon the stated educational requirements of public-education systems, beginning with the state of Utah?

The objective of the work was to make an initial determination of the feasibility of proceeding to adapt, implement, and evaluate within the Utah educational system three Air Force courses selected by Utah representatives: (1) electronic principles, (2) medical service specialist, and (3) aircraft mechanics.

Two work phases were conducted. One was concerned with the establishment of criteria against which the initial assessment of feasibility would be made. Included in this phase was securing personnel capabilities needed to conduct the work.

The second work phase dealt with the selection of manageable segments from each Air Force course, review of the selected segments, and rendering judgments concerning the feasibility of proceeding to adapt, implement, and evaluate each course segment. Course reviews took place at Sheppard Air Force Base, Texas, Lowry Air Force Base, Colorado, and at the various home locations of the project staff. A final review and summary meeting was held at Park City, Utah.

The major finding of the study was that although feasibility varied somewhat as a function of course segment, the judgment of the project staff was unanimous with respect to proceeding with the adaptation, implementation, and evaluation of each course segment within Utah.

The major implication of the work is national in scope. It is likely that many civilian-education systems could benefit greatly (and at modest cost) from use of selected military instructional courses.

It is recommended that steps be taken immediately to proceed with the program in Utah.

APPENDIX

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